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of chromosomes (*ceteris paribus*) regulates the size of the nucleus and furnishes the best evidence for the individuality hypothesis. Nuclear fusion and reduction of chromosomes are regarded as important autoregulative processes which take place only under definite internal and external conditions. Although admitting that the nucleus is of great importance in transmitting hereditary characters, he does not believe that it is the sole bearer of such characters, but that this function is performed by the nucleus and cytoplasm together.

It is fortunate that physiological methods are being brought to bear upon morphological and cytological problems. The morphologist, with his limited knowledge of physiology, is necessarily one-sided in his methods and conclusions; the physiologist, with a correspondingly limited knowledge of structures and development, brings other methods and other viewpoints to the solution of the problem; and thus each corrects and stimulates the other, so that problems which either could not solve alone become possible. The strict morphologist and cytologist will find in this book much with which he cannot agree, but nevertheless he will be compelled to recognize it as a valuable contribution to the subject.—CHARLES J. CHAMBERLAIN.

### Response to light

MAST[2] has written a thoroughly interesting book on the response of organisms to light. It consists of four parts: "Introduction and historical review" (pp. 1–57); "Experimental observations and discussions bearing on the question as to how organisms (especially those without eyes) bend or turn and move toward or from a source of stimulation" (pp. 59–235); "General considerations of reactions to light" (pp. 236–298); and "Reaction in light of different wave-lengths or colors" (pp. 304–393). A bibliography of 14 pages cites the more important literature on the subject, and frequent and excellent summaries make the main conclusions readily accessible.

The work brings together our knowledge of the response to light in plants, motile and sessile, and in animals, protozoa and metazoa. It is a consideration of response to light from the evolutionary point of view. MAST says, "the generality of the treatment of the subject of actions in organisms, including plants as well as animals, it is hoped will make the work of value to all students of nature, especially to those interested in comparative psychology, zoology, botany, and physiology."

Much of the second part is a statement of the author's own research. His work was mainly with animals, yet he has made contributions to plant response. He takes up the long discussed question as to whether directive response to light is determined by the direction of the rays or by the difference of intensity on different flanks. He uses the maize seedling with apparatus that apparently answers all the objections to former methods. His results seem to prove conclusively that OLTMANN'S intensity theory is right, and that SACHS'S ray direction theory is wrong. This chapter alone is no mean contribution.

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[2] MAST, S. O., Light and the behavior of organisms. 8vo. pp. xi+410. *figs. 35.* New York and London: John Wiley and Sons. 1911.

At many points the author opposes LOEB'S conception of response. This is done with vigor, if not with feeling. Quotations from the summary of part II put forth some of the questions in dispute: "There is no conclusive evidence, except perhaps in animals with image-forming eyes, showing that light acts continuously as a directive stimulus, that symmetrically located sides are continuously stimulated, equally when the light intensity on them is equal, unequally when it is not, and this regulates orientation by regulating the rate of motion of the locomotor apparatus on the two sides as is demanded by the theories of DECANDOLLE, LOEB, VERWORN, DAVENPORT, and RÁDL."

"There is no conclusive evidence showing that orientation in light is ever due to tropic reaction in any organisms, if the definitions of tropisms given by LOEB, VERWORN, or RÁDL are used as criteria."

"The idea of reactions to change of intensity, however, is not original with LOEB, as is sometimes assumed. The explanations of reactions to light given by ENGELMANN, BERT, GARBER, LUBBOCK, ROMANES, DARWIN, and others, all of whom preceded LOEB, were largely founded on this idea."

The work in the main agrees with JENNINGS' results and conclusions from his extensive studies. It supports his views on trial reactions, motor reflex, physiological state, and the adaptive character of reactions.—WILLIAM CROCKER.

## MINOR NOTICES

**Trees and shrubs of Southern California.**—Abrams[3] has published the results of an extended field and herbarium study of the trees and shrubs of southern California. The territory involves about 40,000 square miles, or approximately one-fourth the area of the entire state. The author gives a careful consideration of the general physiographic and phytogeographic features of the southern portion of the state, and divides this area into three floral regions: (1) *the coastal slope*, (2) *the mountain*, and (3) *the desert*. The species of the first region are said to be "principally of Californian origin," of the second "boreal or of boreal ancestry," and of the third "endemic or migrants from the Great Basin, Sonora, or Lower California." Each floral region is divided into zones, in accordance with MERRIAM'S outline, and these again are defined and characterized in more or less detail.

The body of the work bears the modest title of "Annotated catalogue of the southern California trees and shrubs." It is indeed far more that the term "catalogue" implies, since the text is provided with succinct keys to genera and species in most of the larger groups; there is also a limited amount of synonomy, copious notes, and ample citation of exsiccatae. New species

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[3] ABRAMS, LEROY, A phytogeographic and taxonomic study of the southern California trees and shrubs. Bull. N.Y. Bot. Gard. **6**:300–485. *pls. 10.* 1910.